



Mount Rainier National Park

Sister Mountain Project

King of the Mountain

Overview	Students will learn about the low-elevation forest, mid-elevation forest, subalpine forest/meadow, and alpine life zones on Mount Rainier by creating a playdough volcano and plant and animal adaptation cards to determine which team is “king of the mountain.”
Grade Level	6-8
Objectives	Students will (1) identify characteristic life forms in each of the four main life zones, (2) describe adaptations of the living things in each ecological community, (3) identify that there are no set boundaries for the plants and animals of a life zone and that organisms migrate through more than one life zone.
Setting	Classroom
Time Frame	One 50-minute period to introduce the life zones and make the identification cards and another 50-minute period to divide into groups, play the game, and have time for discussion afterwards.
Materials	<ul style="list-style-type: none">✓ 20 3x5 cards cut in half✓ Research materials (internet or natural history books on Mount Rainier, student handout)✓ 4 different colors of playdough or clay for 4 groups to make a model of Mount Rainier (about 2 lbs per group, see attached recipe to make at home)✓ 16 8x11 pieces of scrap paper✓ 4 rulers✓ toothpicks✓ scotch tape✓ 4 cups and bowls (or small traffic cones if available)
Vocabulary	temperate, life zone, conifer, canopy, understory, Douglas-fir, western red cedar, western hemlock, subalpine, alpine, scree fields, adaptation, ecosystem, habitat, Krummholz
Standards	6-8 LS2A An <i>ecosystem</i> consists of all the <i>populations</i> living within a specific area and the nonliving <i>factors</i> they interact with. One geographical area may contain many <i>ecosystems</i> .

	<p>6-8 LS2D <i>Ecosystems</i> are continuously changing. Causes of these changes include nonliving <i>factors</i> such as the amount of light, range of temperatures, and availability of water, as well as living <i>factors</i> such as the disappearance of different <i>species</i> through disease, <i>predation</i>, <i>habitat</i> destruction and overuse of resources or the introduction of new <i>species</i>.</p> <p>6-8 SYSA Any <i>system</i> may be thought of as containing <i>subsystems</i> and as being a <i>subsystem</i> of a larger <i>system</i>.</p> <p>6-8 SYSB The boundaries of a <i>system</i> can be drawn differently depending on the features of the <i>system</i> being <i>investigated</i>, the size of the <i>system</i>, and the purpose of the <i>investigation</i>.</p> <p>6-8 SYSF The <i>natural</i> and <i>designed world</i> is complex; it is too large and complicated to <i>investigate</i> and comprehend all at once. Scientists and students learn to define small portions for the convenience of <i>investigation</i>. The units of <i>investigation</i> can be referred to as "<i>systems</i>."</p> <p>6-8 INQE —Model— <u>Models</u> are used to represent objects, events, <u>systems</u>, and processes. <i>Models</i> can be used to test <i>hypotheses</i> and better understand <u>phenomena</u>, but they have limitations.</p>
Background	<p>Every organism has certain traits and behaviors that allow it to live in a particular environment. This activity allows students to match plants and animals to the life zones on Mount Rainier and to compare and contrast adaptations that apply to each life zone. The uniqueness of mountains is that within a short distance one can experience a great diversity of organisms adapted to a broad range of temperature and moisture extremes. Climbing a mountain shows a similar number of different ecosystems to starting from our southern states and driving north thousands of kilometers.</p> <p>The elevation of Mount Rainier spans from 450 meters at the base to 4,392 meters at the summit. For every 300 meter increase in elevation the temperature drops about 15° Celsius. You can go from a temperate world of moderate temperatures to the Arctic tundra simply by climbing the mountain. This wide elevation range supports a corresponding variation in vegetation and wildlife. Belts of similar vegetation are referred to as life zones. There are four main life zones in Mount Rainier National Park, although no sharp boundaries separate them and species overlap. Following is a brief description of each zone.</p> <p><i>Low-Elevation Forest</i> 518-762 meters</p>

- Mature (up to 1,000 years old) forests of large, old conifers, both living and dead (dead trees are called snags if standing, nurse logs if fallen)
- Very little sunlight reaches the forest floor; thick ground cover of smaller plants such as mosses, ferns, fungi and flowers
- Dense, multi-layered canopy; with the topmost canopy level reaching up to 60 meters; sparse understory of shade tolerant trees; fair number of shrubs
- Animal and plant species are very diverse, and the majority of different species can be found here

Trees: Douglas-fir, western red cedar, western hemlock, grand fir
Understory plants: vine maple, devil's club, Oregon grape, salal, sword fern
Birds: owls (great horned owl, western screech owl, etc.); woodpeckers (northern flicker and hairy woodpecker); and jays (grey jay and Steller's jay)
Mammals: bats (*Yuma myotis* and long-legged *myotis*), rodents (long-tailed vole and northern flying squirrel); black-tailed deer, raccoons, mountain lions
Other: Northwestern garter snake, gopher snake, Pacific tree frog, banana slugs

Mid-Elevation Forest

762-1,220 meters

- More open areas and less Douglas fir and western hemlock.
- Sparser understory; heavier shrub layer
- More barren forest floor (less moss)

Trees: pacific silver fir, noble fir,

Understory: Huckleberry (Alaska, black, oval-leaf, and red), bunchberry, rhododendron, goats beard, tiger lily

Birds: yellow-rumped warbler, chipping sparrow, northern harrier

Mammals: elk, black bear, red fox, bobcat, marten, heather vole

Subalpine Forest and Meadow

1,220-1,981 meters

- Areas of low vegetation mixed with clumps of trees, large scree fields
- Severe climate and a short growing season results in little annual woody growth
- Trees are small and narrow; branches flex to shed heavy snows

Meadows covered in snow most of the year, but in mid-summer melt out and reveal beautiful wildflowers.

Trees: subalpine fir, mountain hemlock, Alaska yellow cedar

Flowers: lupines, avalanche lilies, paintbrush, bistort, heather, etc.

Mammals: mountain goats, marmots, snowshoe hare

Birds: blue grouse and Clark's nutcracker, red-tailed hawk

Other: bumble bees, flies, Cascade frog

Alpine

1,981-4,392 meters

- Also known as tundra
- A harsh, rocky landscape above tree line with uniquely adapted, hardy

	<p>plants that take on the Krummholz (a German word for crooked or twisted) form, shrubs and smaller plants take on pin cushion form “huddling” together to create more heat</p> <ul style="list-style-type: none"> • Freezing temperatures and gale force winds • Perpetual ice and snow found above fell fields (stone “fields”, less than half covered with plants) <p><i>Plants:</i> heather, lupine, algae, lichens, watermelon snow</p> <p><i>Mammals:</i> deer mice, pika</p> <p><i>Birds:</i> white-tailed ptarmigan</p> <p><i>Other:</i> Vidler’s alpine, ice worms</p>
Procedure	<p><i>Prepare cards</i></p> <ol style="list-style-type: none"> 1. Review the life zones of Mount Rainier with students using a PowerPoint presentation which illustrates the biotic and abiotic components of each life zone. Discuss how plants, animals and physical factors change with elevation. 2. Divide the class into four equal groups—one for each life zone. Have each group come up with a team name that relates to their life zone (sub-alpine team could be called the Marmots for example). 3. Students then research plants, animals, and physical features. Also include adaptations, whether specific to an organism or general adaptations. Students can use internet, listed references, or if none are available see attached student handouts that students can use to gather information on an animal of their choice. 4. For each ecosystem, students should make five cards, one for each of five species of plants or animals in their life zone. Do not write the name of the animal on the card. The cards should describe adaptations that enable the animals to survive in the ecosystem. For example: “Has large broad leaves to catch any sunlight filtering through the tall Douglas-firs, and the spiky thorns make it live up to its name” (devil’s club) 5. Make sure students make a master key to refer to later so they don’t forget what organism each clue represents. 6. Collect the cards from all four teams and redistribute to the different life zone teams (make sure teams don’t get their own life zone cards!). <p><i>Prepare 3-D mountain and play game (can be done the next day)</i></p> <ol style="list-style-type: none"> 7. Before class, obtain or make (see attached recipe) a total of 1.5 kg of playdough or soft clay per team, totaling about 5.5 kg. Making playdough takes about 10 minutes per color. Designate a color for each of the four life zones (for example green for low-elevation forests). Each group will need about 1 kg of low-elevation color, and then about a .5 kg of all the other colors combined. To estimate the volume, a pound of playdough equals about two adult fists put together. 8. In class, distribute all four colors of play-dough, a bowl, a cup, a ruler and a piece of scrap paper to each group. Put the bowl upside down on the sheet of paper and the cup upside down on the bowl. Write on the

	<p>board a scale for the mountain. For a normal sized soup bowl and cup 1 cm= 200m. (Students can round up for elevations to the nearest hundred meters.) Also write on the board what color each life zone is. Over the bowl and cup, have students wrap the play-dough around the bowl and cup to create a volcano, the student's interpretation of Mount Rainier. They will start with the low-elevation forest color and build it up to the correct height to match the 762 meter elevation mark. Encourage students not to mix the colors or else the zones will not be distinguishable. Remind them that Mount Rainier is not a perfect cone, and has different valleys and steepness of slopes. Some of these valleys are u-shaped or v-shaped, and there are steep, tall ridges.</p> <ol style="list-style-type: none"> Students then tape the cards to toothpicks. As a group, students guess what each organism is, writing it on a separate sheet of paper, and then stick the organism card in what they think is the correct life zone on the mountain. The student information handout can be a reference, but see which ones they can get without looking. Get back together as a class and have students move from mountain to mountains. Take any incorrectly placed card off the mountain, and add up the cards left on the mountain. The team receives one point for every correctly placed card. Students take the cards that were taken off the mountain and try to find the correct place. The group with the most points wins. Then have a discussion about which organisms they think could be in more than one life zone or might migrate depending on conditions and seasons. Have students move the cards as each one is discussed about. For clean up, if students are careful, each layer can be peeled off without too much color mixing and can be used again for another class.
Suggested Assessment	<ol style="list-style-type: none"> Which ecosystem do you think is the most interesting or exciting? Describe to someone who has never been to a mountain what that ecosystem looks like; include living and non-living components and describe adaptations. Which organisms will for sure only be found in a specific life zone? Make a Venn diagram comparing any two ecosystems.
Adaptations	<ul style="list-style-type: none"> Other mountains could be compared and contrasted such as Mount Rainier and Mount Fuji. Obtain a topographic map of Mount Rainier and have students trace every 1,000 foot line on separate sheets of paper (so there would be one sheet of paper the 2,000 foot elevation line and another sheet of paper for the 3,000 foot elevation line). Then students use that sheet of paper to sculpt playdough into a layer of the mountain. Take the sculpted layers of playdough and pile them on top of each other to make a 3-D topographic map of Mount Rainier and play the game using that mountain. Find a favorite edible playdough recipe on the internet, and if students are careful to wash their hands, the mountain can be eaten afterwards.
Extensions	<p>See <i>Twilife Zones</i> lesson plan for a field activity to do at Mount Rainier where students take the knowledge gained from this activity and use it to better</p>

	understand life zones in the field.
References/ Resources	<p>Council for Environmental Education. (2008). <i>Project Wild: K-12 Curriculum and Activity Guide</i>. Houston, TX: Author.</p> <p>Mathews, Daniel. (1999). <i>Cascade-Olympic Natural History: A Trailside Reference</i>. Portland, OR: Raven Editions.</p> <p>Wuerthner, George. (2000). <i>Mount Rainier: A Visitor's Companion</i>. Mechanicsburg, PA: Stackpole Books.</p>